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THE MYXOMYCETES AND FUNGI OF COLORADO

ELLSWORTH BETHEL, A. M.

AND

WM. C. STURGIS, Ph. D.

NO. 1. THE MYXOMYCETES OF COLORADO

W. C. STURGIS

COLORADO SPRINGS, COLORADO

SEPTEMBER, 1907

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With compliments of E. Bethel.

NOTE.

The series of papers, of which the present one is the first, is intended to cover the mycological flora of Colorado. The Rocky mountain region has heretofore received little attention on the part of mycologists, first, because the rich and varied phanerogamic flora has engrossed the attention of botanists, and secondly, because it has been assumed that such an arid region offered no attractions to mycologists. This assumption, however, is unwarranted. During the past ten years or more, Mr. Bethel has collected a vast quantity of material in all groups of fungi, and the fact has become apparent that the region explored, so far from being devoid of these plants, presents an extraordinarily rich field for the mycologist. That the present paper includes almost one hundred species and varieties of *Myxomycetes* from the state of Colorado alone, is certainly a striking and unexpected fact. In preparing this series of papers each of the collaborators will, as a rule, treat the group or groups in which he has specialized and will be solely responsible for his own work, but in certain cases the work will be done conjointly.

Although much material is already on hand, collectors and students throughout the State are earnestly requested to send in specimens. All specimens received in this way will be determined and due credit given to the collector.

ELLSWORTH BETHEL, A. M.,
President Colo. Acad. of Science.
W. C. STURGIS, PH. D.,
Dean Colo. School of Forestry.

+ 101 sp. + var.

× This is a false statement. All work was to be done jointly. The above note was written by Sturgis and my name attached without my knowledge or consent and this publication is issued by Sturgis in direct violation of our agreement.
Ellsworth Bethel.

THE MYXOMYCETES OF COLORADO.

WM. C. STURGIS.

INTRODUCTION.

The *Myxomycetes,* or *Mycetozoa,* form a natural group of organisms bearing an indefinite relationship on the one hand to the *Protozoa* and on the other to certain of the lower *Fungi.* So vague is this relationship, however, that, without stretching the observed facts, they cannot be placed in either group. Nor indeed, can it be said with any certainty whether they should be classed as plants or as animals; nevertheless the study of these organisms is, and always has been, mainly in the hands of botanists, probably because in their reproductive phase they bear a certain external resemblance to the fungi, many of them having been included among the "puff-balls" by the earlier writers.

LIFE HISTORY.

Briefly, the *Myxomycetes* are characterized by a vegetative phase, consisting of a naked, venulose or pulvinate, protoplasmic mass, often attaining a large size and possessing a striking color, and exhibiting streaming movements within its substance, as well as amœboid movements of the whole mass. This is known as the *plasmodium.* The plasmodium has a distinct affinity for water and obscurity; hence it usually affects the lower surface of rotten logs, the interstices of bark or wood, the interior of damp leaf-heaps and similar locations. Before passing over to the reproductive phase, the plasmodium moves toward the light and to a drier portion of the substratum. Here it becomes transformed into fruiting bodies of manifold forms according to the species. In a single instance the fruiting body consists of columnar prolongations of the plasmodium, which rise erect and eventually produce on their surfaces vast numbers of *spores.* Usually, however, this phase is in the form of *sporangia,* which may be of various shapes, stalked or sessile, simple or compound, spherical or elongated *(plasmodiocarps).* Frequently the fruiting body consists of a multitude of convo-

luted sporangia, inextricably united and forming a mass of considerable size known as an *"æthalium."* In any case, however, the interior of the sporangium, at first similar to the plasmodic matter from which it was derived, becomes differentiated before maturity into spores and, in many cases, into delicate threads which may be either free *(elaters)* or united into a network known as the *capillitium.* Meantime the sporangium itself develops a more or less firm wall, on the surface of which may be deposited, in the form of crystals or granules, a varying quantity of lime heretofore held in suspension by the plasmodium. Such deposits of lime, together with refuse matter, may also occur in the stalk and in the threads of the capillitium. Frequently the stalk is prolonged upward into the sporangium and appears either as a rounded body at the base of the sporangium, or elongated, sometimes to the very apex of the sporangium. This is known as the *columella* and from it spring the main branches of the capillitium.

The spores are usually spherical bodies with a firm, colored wall which is either smooth or marked with papillæ, spines, or raised bands. Under suitable conditions the spore germinates and produces a motile, amœboid body known as a *swarm-spore.* Eventually neighboring swarm-spores unite and by their union form the plasmodium.

Such in brief outline is the life-cycle of an ordinary *Myxomycete.*

As a rule they are to be looked for in warm, damp situations. It is therefore rather surprising to find them occurring in great variety and abundance under the rather arid conditions prevailing in Colorado and at every degree of altitude up to 10,000 feet. Of course there must be, for their best development, a certain amount of protection and moisture. Hence they are to be looked for, as a rule, in shady cañons or in the forests where fallen logs decay and hold the moisture. In such places we find them growing luxuriantly.

COLLECTION AND PRESERVATION.

In collecting *Myxomycetes* the most convenient method is to detach each colony together with a portion of the substratum and wrap the whole in a twist of tissue paper. In this way even the more delicate forms can be safely carried. To preserve them it is only necessary to let them remain exposed to the air until thoroughly dry and then glue them to cards cut to fit oblong paper slide-boxes and removable

therefrom. If the two ends of the card are bent up at right angles they will serve to keep the card firmly in the box when the cover is in place.

It is often advisable to collect a plasmodium and allow it to develop, in which case it may be placed in a tin box and held in place by damp paper or moss. Care, however, must be taken that the plasmodium does not come in contact with the box or the packing and that a sufficient quantity of the substratum be removed with the plasmodium to insure its further development. As soon as practicable the specimen should be removed from the box and placed on damp paper under a bell-jar at the ordinary room-temperature, when, if all goes well, it will be transformed into the fruiting bodies within a few hours.

MICROSCOPIC EXAMINATION.

For the microscopic examination of the *Myxomycetes* it is only necesary to pick off a single sporangium or bit of an æthalium, place it in a drop of alcohol on a glass slide in order to remove the air, then replace the alcohol with a drop of water and cover with a cover-glass. For permanent mounts glycerine jelly or Canada balsam may, after due preparation of the specimen, be used. The writer, however, prefers a mixture of glycerine and acetic acid in equal parts, boiled and then cooled. Of course this is ruinous to any specimen containing lime, in which case plain glycerine is used. A drop either of the mixture or the glycerine is placed on one end of the slide bearing the specimen mounted in water; to this a few drops of water are added and thoroughly mixed by stirring with a needle; the mixture is then drawn up to the edge of the cover-glass and the slide is placed in a shallow drawer or other receptacle where it will be free from dust. In the course of a week or ten days the water and the acid will have evaporated and the specimen is now in pure glycerine. The cover-glass is now ringed with King's Red Lacquer Cement until the ring is perfectly opaque. Specimens so prepared are free from shrinkage and distortion and may be kept indefinitely.

LITERATURE.

The literature of the *Myxomycetes* is very extensive, but for the beginner one of two books only is essential, Macbride's *North American Slime-Moulds*, published by the Macmillan Co., New York, or Lister's *Monograph of the*

Mycetozoa, published by the British Museum. The former is by far the best account ever published of the American forms; the latter has a wider scope and is intended to include all known species.

In preparing the present paper the writer intended at first to make it a mere list of the species heretofore found in Colorado. But during the three years that it has been in course of preparation, the amount of material has become so large, the number of persons who have shown interest in this group of organisms has so increased, and so many forms demanding more than a brief notice have been added to the collection, that it has seemed best to enlarge the scope of the paper so as to make it in some degree a beginner's guide to the *Myxomycetes* in general and a more or less critical survey of the Colorado species in particular, by means of which those interested can determine the genus and possibly the species. To this end the writer has made use of Mr. Lister's Synopsis of the Orders and Genera included in his Monograph, selecting, however, only those genera at present known to occur in Colorado.

KEY TO THE ORDERS AND GENERA OF MYXOMYCETES KNOWN TO OCCUR IN COLORADO.

A. Spores developed outside the Sporophores. *Ceratiomyxa.*

AA. Spores developed inside a Sporangium.

B. Spores violet, violet-brown, or pale ferruginous.

C. Sporangia provided with lime.

D. Lime in minute granules. *(Physaraceae.)*

a. Capillitium charged with lime throughout. *Badhamia.*

b. Capillitium with lime-knots only.

* Fructification compound, (æthalioid) *Fuligo.*

** Fructification simple.

§ Sporangium wall membranous, calcareous. *Physarum*

§§Sporangium wall cartilaginous.

Sporangia plasmodiocarps *Cienkowskia.*
Sporangia with a lid *Craterium*
Sporangia ovoid, shining *Leocarpus*

c. Capillitium without lime-knots *Diderma*

d. Lime confined to stalk and columella *Diachæa*

DD. Lime in crystals. *(Didymiaceae.)*

a. Fructification simple, *Didymium*

b. Fructification compound. *Spumaria*

CC. Sporangia without lime *(Stemonitaceae)*

a. Sporangium wall evanescent.

Capillitium forming a net at surface of sporangium *Stemonitis*

Capillitium not forming a surface-net *Comatricha*

Capillitium springing from apex of columella only *Enerthenema*

b. Sporangium wall somewhat persistent, iridescent. *Lamproderma*

BB. Spores variously colored, never violet

a. Capillitium wanting, or not forming a system of uniform threads.

* Sporangium-wall with granular deposits, netted above, except in *Lindbladia*. *(Heterodermaceae)*

§ Sporangia sessile, compacted *Lindbladia*

§§Sporangia stalked

Network irregular *Cribraria*

Network of parallel ribs extending longitudinally from base to apex *Dictydium*

** Sporangium-wall without granular deposits; sporangia tubular, compacted *(Tubulinaceae)*

Sporangia without columella *Tubulina*

*** Sporangia combined into an æthalium *(Reticulariaceae)*.

Sporangium-walls represented by 4-6 straight threads extending from base to apex. *Dictydiæthalium.*

Sporangium-walls with large round perforations. *Enteridium.*

Sporangium-walls incomplete, frayed out. *Reticularia.*

b. Capillitium present, a system of uniform threads.

* Capillitium marked with spirals. *(Trichiaceae)*

§ Capillitium of free elaters. *Trichia*

§§ Capillitium combined into a net. *Hemitrichia.*

§§§ Capillitium of fasciculate threads, repeatedly bifurcating. *Prototrichia*

** Capillitium abundant, marked with cogs, half-rings, spines or warts *(Arcyriaceae)*

§ Sporangia stalked, wall evanescent. *Arcyria.*

§§ Sporangia sessile, wall persistent, thick. *Perichæna.*

*** Aethalioid. Capillitium of smooth or wrinkled tubes. *Lycogala*

CERATIOMYXA, *Schroeter.*

CERATIOMYXA MUCIDA, *(Pers.) Schroet.*—This common species occurs everywhere throughout the region explored. The following localities indicate the range:—Bear Creek Cañon, Colorado Springs, (Hall); Boulder, (Bethel & Sturgis); Tolland, (Bethel); San Juan Mts., (Bethel); Ouray, (Bethel).

The so-called *var. porioides, A. & S.* has not been reported from Colorado, a fact which adds weight to the view that the two forms are specifically distinct.

BADHAMIA, *Berkeley.*

BADHAMIA PANICEA, *(Fr.) Rost.* According to Macbride, "this seems to be a purely western species." Wherever fallen logs of cottonwood or box-elder are found in damp situations, the whitish plasmodium occurs in abundance, developing into the small, gray, crowded or scattered sporangia. At Boulder the species is especially abundant, occurring in company with *B. populina, List,* and related forms. It has also been collected at Fort Collins, (Bragg), and a limeless form has been found at Golden, (Bethel).

The specimens on box-elder usually show smaller and more densely clustered sporangia than those on cottonwood. Occasionally the sporangia are stipitate, and more rarely forms occur in which the capillitium shows a few short hyaline threads connecting the lime-knots as is noted by Lister (Mon. p. 34) in the case of the varietal form *B. verna, Rost.*

BADHAMIA POPULINA, *List.* During the summer of 1906 numbers of specimens of a *Badhamia* were sent in by Mr. Bethel, chiefly from Denver and Boulder. The white, gray or pinkish sporangia occurred usually in dense clusters, rarely as separate individuals, on the bark of cottonwood and box elder. In most cases the sporangia were supported on long, membranous, straw-colored stalks. These features, together with the fact that the spores were in clusters of eight to fifteen or more individuals, were so distinctive of *Badhamia capsulifera, (Bull.) Berk.,* that the specimens were at once referred to that species. Upon closer examination, however, the spores were found to exhibit a peculiar feature, being marked with more or less distinct bands or

ridges dividing the surface into three or four triangular areas and a corresponding polygonal area at the broader end. This feature was not always apparent, the specimens on box-elder showing only occasional and very faint bands. At first these bands were taken to be mere pressure-ridges produced by the mutual compression of the spores as they formed in the clusters, but on looking over the literature it was found that Mr. Lister had described, under the name *Badhamia populina*, a species similar to *B. capsulifera* but distinguished from it by a white instead of a chrome-yellow plasmodium and spores banded precisely as in our specimens. (Journ. of Botany: Vol. 42, May, 1904, p. 129.) This led to a personal investigation of the plasmodium, when the latter was found to be uniformly of a whitish color without a tinge of yellow. Specimens were submitted to Mr. Lister and were determined by him as *B. populina*.

Were the banded spores the only feature in which our specimens differ from *B. capsulifera*, they might not serve as a distinctive feature, but taken in connection with the white plasmodium it seems at present advisable to follow Lister in regarding *B. populina* as a distinct species. As to its occurrence in this country, it is probably more widely spread than is at present supposed, having been collected as *B. capsulifera*. The color of the plasmodium is usually overlooked by collectors and, in the present instance, the banding of the spores becomes apparent only with high magnification. Macbride makes no mention of the color of the plasmodium in either *B. capsulifera* or in the related species, (a *variety*, according to Lister), *B. papaveracea*. Under date of October 27th, 1906, Mr. Lister writes: "We have never received our typical European form of *B. hyalina* (*B. capsulifera*) from America. We have had *var. B. papaveracea* sixteen times. All you have sent from Colorado with white, heaped-up sporangia and white or cream-colored plasmodium, are, we believe, *B. populina*." As above remarked, while it may seem probable that in *B. populina* we have only a marked variety of *B. capsulifera*, there can be no certain conclusion unless specimens are found showing a yellow plasmodium and banded spores, and for the present the name *B. populina* is retained for the form with white plasmodium and more or less distinctly banded spores. It has thus far been collected at Boulder, (Bethel and Sturgis); Morrison, (Bethel); Denver, (Bethel) and Fort Collins, (Bragg).

BADHAMIA VERSICOLOR, *List.* This interesting species was first collected by Mr. Bethel at Boulder in July, 1906, and later by Mr. Bethel and the present writer in the same locality. In both instances it occurred on the bark of box-elder, often in company with *B. populina.* Specimens were submitted to Mr. Lister and determined by him. Since it has not before been reported from America and the original description is not readily accessible, the latter is here given in full.

"Plasmodium? Sporangia sessile, sub-globose, 0.3-0.5 *mm. diam., pure grey or grey with a tinge of flesh-colour, scattered or in small groups; sporangium-wall hyaline, with innate clusters of lime-granules, the lime sometimes scanty or wanting; columella none; capillitium a coarse network of broad or narrower bands densely charged throughout with lime; in some sporangia the granules contained in the capillitium are white, in others apricot-coloured; spores ovoid or somewhat cuneate, arranged in clusters of ten to forty or more, purple-brown and minutely warted on the broad end, pale and smooth elsewhere,* 10 *x* 8—12 *x* 7 *μ* (Jour. of Bot., March, 1901, p. 81.)

The small size of the sporangia would readily cause this species to be overlooked, were it not that they are gregarious, giving the appearance of minute whitish beads sprinkled thickly over the bark. The sporangia are rugose or wrinkled; the base is thickened and of a dark brown color; the lime-knots as well as the sporangium-wall usually show a distinctly yellowish color. The only difference between the Boulder specimens and those described by Lister is that in the latter the spores are in larger clusters.

The species is closely related to *B. capsulifera,* from which, however, it is readily distinguished by the habit and the minute size of the sporangia.

BADHAMIA NITENS, *Berk.* This rare species has been hitherto reported only from England and it is interesting to find it occurring in typical form in the mountains of Colorado. The specimens before us were all collected by Mr. Bethel in August, 1905, on the bark of *Abies concolor* at Ouray, Colo. The greenish-yellow color of the lime in the sporangium-wall and capillitium render it easily distinguishable among the *Badhamias* with clustered spores.

BADHAMIA ORBICULATA, *Rex.* Some confusion has, in the past, existed regarding this species. It is undoubtedly related to both *B. panicea* and *B. macrocarpa,* indeed Mr.

Lister placed it as a variety of the latter species (Mon. p. 34), though in a letter to the writer dated Dec. 15th, 1906, he states that this view was mistaken, being based on insufficient material. It is undoubtedly an autonomous species, differing from *B. panicea* in the short blackish stalks of the stipitate sporangia, but especially in the discoid or annulate form of the sporangia. The smaller, paler spores serve to distinguish it from *B. macrocarpa*. The latter species has not yet been reported from Colorado and seems to be very rare throughout the United States.

The specimens of *B. orbiculata* before us were all gathered in Boulder in September, 1906, by Mr. Bethel and the writer. They occurred uniformly on the bark of cottonwood. With the typical form there occurred in some abundance a form consisting of small, sessile, very much appressed plasmodiocarps with a capillitium of straight, acutely-branching, calcareous rods uniting the lower and upper surfaces of the plasmodiocarp. So marked were these features that they appeared at first to indicate a specific distinction, but further examination showed the presence of intergrading forms apparently connecting the plasmodiocarps and the typical sporangia. So different, however, are these two forms in appearance and in the structure of the capillitium, that it is quite possible that future gatherings may prove the applanate forms to be worthy of at least a varietal position under *B. orbiculata*.

BADHAMIA UTRICULARIS, *(Bull.) Berk.* This species is included in a list of *Myxomycetes* from Colorado in the herbarium of the State University of Iowa, furnished by Professor Macbride. A scanty, immature specimen was found by Mr. Bethel at Tolland, in September, 1906.

PHYSARUM, *Persoon.*

PHYSARUM VIRIDE, *(Bull.) Pers.* This species occurs commonly throughout the State and in all of the three varieties, *luteum*, *aurantium* and *incanum*. The last-named variety very closely resembles *P. nutans, Pers.*

The *var. aurantium* has been collected at Colorado Springs, (Shantz); Tolland, (Bethel); Glen Park, (Sturgis). *Var. luteum* at Glen Park, (Sturgis); Boulder and Tolland, (Bethel). *Var. incanum* at Boulder and Tolland, (Bethel), and Manitou Park, (Sturgis).

PHYSARUM NUTANS, *Pers.* Much difficulty attends the definition of this species owing to the extreme diversity of

views held by the various authorities regarding this and related species.

Typical *P. nutans* is not difficult to recognize. The slender, non-calcareous stipe, the nodding sporangia, the white lime-knots and the rather pale, violet-brown, almost smooth spores, are sufficiently diagnostic. This form is the *Tilmadoche alba, (Pers.)* of Macbride's "Slime-Moulds," and is represented in our collection by specimens from Colorado Springs, (Shantz); Tolland, (Bethel); Boulder, (Bethel and Sturgis); Glen Park, (Sturgis).

It grades almost imperceptibly into a form with larger spherical sporangia erect upon slender or stout sulcate stipes free from lime and varying in color from pale brownish to almost black, and with dark, purplish-brown, rather spinulose spores. This is the *P. compressum, A. & S.* of Lister's Monograph, of which *var.* β is the common form in this country. It is also the *P. nephroideum, Rost.* of Macbride's "Slime-Moulds," although that name is taken by that author to include forms with stalks charged throughout with lime, as, *e. g.* in Ell. & Ev., N. A. F. 2694. Between these two extremes occur a multitude of forms some of which are placed by Lister as varieties of *P. nutans,* while other authorities regard them as species. Thus Lister relegates the name *P. leucophaeum, Fr.* to varietal rank, whereas Macbride maintains the validity of the species, though there is an irreconcilable difference of opinion as to what that name really applies to. Lister applies it to an erect form with globose densely calcareous sporangia; Macbride to a delicate form with scanty deposits of lime represented by Ell. & Ev., N. A. F. 2693. That specimen, however, with its nodding sporangia and pale spores, appears to be typical *P. nutans* with less lime than usual, possibly *var. violascens, Rost.* Still more nearly approaching *P. nephroideum* is Lister's *var. robustum* with densely calcareous sporangia on stout, erect stalks and with larger, more distinctly warted spores. All of these varieties agree in their rather pale violet-brown spores as contrasted with the dark purplish-brown spores of *P. nephroideum.* Evidently, however, this is a distinction in which the personal equation plays altogether too important a part. In many cases it is quite impossible for two observers to agree as to the placing of a certain form under one or the other of the two extremes mentioned above. Under these circumstances the only possible course is to recognize the two centres *P. nutans* and *P. nephroideum* and to arrange the inter-

mediate forms under whichever centre they seem to approach most nearly.

A form occurs rather abundantly in the neighborhood of Boulder, which differs considerably from normal *P. nutans* but which we include under that species. The sporangia are globose or sub-globose, clear gray with patches or lumps of pure white lime on the surface, and measure 0.4-0.5 mm. in diameter. They are erect on slender or stout, tapering, black stalks, devoid of lime. The capillitium consists of an abundance of very slender threads, with few and small or many and larger fusiform or rounded lime-knots. The spores measure 9-11 μ, are almost smooth or minutely warted and of a clear violet-brown or almost claret-color.

Another form is similar, but the sporangia are rather larger, measuring as high as 0.7 mm. in diameter. They are either sessile or possess short, furrowed stalks of a dirty yellowish color. The capillitium is more robust but the spores are identical with those of the form described above.

Both of these are certainly forms of *P. nutans* as understood by Lister, and are placed under his *var. robustum*. They have been collected at Fort Collins, (Bragg); Boulder, (Bethel and Sturgis); Ouray, (Bethel).

PHYSARUM NEPHROIDEUM, *Rost.*. This name is adopted in place of the *P. compressum, A. & S.* of Lister's Monograph, for the reasons given by Macbride, ("Slime-Moulds", p. 40), which seem to the writer amply sufficient. The species, readily distinguished by its dark, purplish brown, usually rather spinulose spores, appears to be common throughout the State. It has been collected at Boulder, (Bethel & Sturgis); Grand Mesa, Ouray, Tolland, and Fort Collins, (Bethel). The Fort Collins gathering shows a remarkable approach to *Physarum nodulosum, Cke. & Balf.*, in the reddish-brown stalk, merging into the concolorous and persistent base of the sporangium, but the dark, spinulose spores leave no doubt as to its proper position.

PHYSARUM CINEREUM, *(Batsch) Pers.* Mr. Bethel finds this species ocurring abundantly on grass, leaves and fallen twigs at Boulder and Golden. All of the gatherings are typical in habit and in detail.

PHYSARUM CONTEXTUM, *Pers.* This species is recognizable at sight by its densely aggregated habit and pale yellow, calcareous sporangia, often encrusting or sheathing the fallen twigs, leaves and bits of bark on which it occurs. It is

reported from Glen Park, (Sturgis); Palmer Lake and Golden, (Bethel); Boulder, (Bethel & Sturgis).

PHYSARUM VERNUM, *Sommerf.* In September, 1906, Mr. Bethel collected near Denver a small quantity of a form bearing a marked resemblance to *Physarum cinereum.* The gray, isolated or gregarious sporangia (occasionally plasmodicarps) are very small (0.4-0.6 mm. diam.) and are sessile upon a dead herbaceous stem. The fragile, single sporangium-wall easily breaks away, exposing the persistent white capillitium and black spore-mass. The capillitium consists of very abundant small rounded lime-knots with delicate connecting threads. The spores measure 10-11 μ diam. and are very dark purplish-brown (a color which also faintly tinges the sporangium-wall), and distinctly spinulose.

Macbride lists three species to which this form is somewhat similar—*P. cinereum, P. plumbeum* and *P. atrum.* From *P. cinereum* it certainly differs in the color and sculpture of the spores, and since the former feature is apparently repeated in the other two species mentioned, the identity of the form under consideration with either of them is precluded, even if it were not for differences in other points and the very doubtful validity of both *P. plumbeum* and *P. atrum.*

Except for the smaller size and the generally globose form of the sporangia, the Denver gathering corresponds to a specimen of *P. vernum* in the writer's herbarium, collected in England and determined by Mr. Lister after an examination of Sommerfelt's type. Regarding this species Mr. Lister writes (Journ. of Botany, Vol. 35, p. 210, June 1897), "On the one hand it is allied to *Physarum cinereum,* which it resembles in the sessile plasmodiocarps as well as in the capillitium. On the other hand it is allied to *Physarum compressum (P. nephroideum)* in the dark spores. Before receiving Sommerfelt's type I had contemplated publishing an account of the form as a dark-spored variety of *Physarum cinereum,* which is normally characterized by its pale spores; it is satisfactory however, to be able to trace it to a species already named, for notwithstanding the intermediate place which it holds between its two companions, rendering some gatherings difficult to determine, yet the main characters are constant."

This species has not been before reported from America and is represented by the single gathering referred to.

PHYSARUM DIDERMA, *Rost.* A peculiar form of this species occurs at Boulder and has been collected on two different occasions by Mr. Bethel and the writer. It consists almost entirely of rather long sinuous plasmodiocarps resembling *Physarum sinuosum, (Bull.) Weinm.* These, however, are not laterally compressed as in that species, nor do they split open along the upper edge. The inner wall of the sporangia shows the purplish tint characteristic of *P. Didcrma* and the spores are dark purplish-brown in color, strongly spinulose on one side and measure 9-10.2 μ diam. The spores of *P. sinuosum* are paler, smaller and less coarsely but more evenly warted. Undoubtedly, however, the two species are very closely allied.

PHYSARUM SINUOSUM, *(Bull.) Weinm.* This common species occurs abundantly throughout Colorado. Specimens are before us from Buena Vista, Golden, Tolland, Boulder, and Palmer Lake, all collected by Mr. Bethel. The compressed sporangia, the outer wall splitting irregularly not rolling back from the persistent inner wall, the character of the spores, and the more regular rod-like capillitium with branching rather than rounded lime-knots, are features which serve to distinguish this species from the preceding one.

PHYSARUM DIDERMOIDES, *(Ach.) Rost.* The typical form of this species, with ovoid or cylindrical sporangia supported on white or yellowish membranous stalks, has not been reported from Colorado.

A specimen has been received from Boulder, (Bragg) showing small, crowded, spherical and sessile sporangia, somewhat resembling *Physarum cinereum.* The sporangium wall is, however, double and the spores are dark purplish-brown, spinulose, and measure 11.7-12.8 μ in diameter. In these features the gathering accords perfectly with *P. didermoides.* The shape of the sporangia in that species is a very variable character.

PHYSARUM TESTACEUM, *n. s.* In August, 1905, Mr. Bethel collected at Ouray, Colo., a peculiar *Physarum*, identical with a number of forms in the writer's collection which had been placed provisionally under the name *Physarum didermoides, var. lividum, (Rost.) List.*, (Jour. of Bot., May, 1898, p. 1.). Specimens of this gathering were sent to Mr. Lister and were confirmed by him, with the suggestion, however, that the variety showed so many points of difference from typical *P. didermoides* that it might well be considered

worthy of specific rank. The Ouray specimens may be described as follows:

Plasmodium? Sporangia subglobose, closely gregarious, or clustered and polygonal from mutual compression, 0.7 mm. diam., sessile. Sporangium-wall usually double; the outer white, smooth or wrinkled, delicate and shell-like; the inner membranous, colorless. Capillitium of numerous large or small, branching, angular, white lime-knots, connected by delicate, hyaline threads. Spores dark violet-brown, spinulose, but distinctly darker and more strongly spinulose on one side; 8-10.2 μ diam. On bark of Abies concolor; Ouray, Colo., leg. Bethel, Aug, 1905.

Except in the purer white of the sporangia, this species has a certain resemblance to *Badhamia panicea.* The plasmoduim was not seen but Lister *(l. c.)* gives the color as white. From *P. didermoides,* the form under consideration differs in the shape of the sporangia, the absence of a stalk, the usually shell-like double wall, the larger angular lime-knots, and the unequal thickness of the spore-wall. In the last-named feature it differs *(teste* Lister *in litt.)* from *P. lividum, Rost.,* in which the spores are equally dark and spinulose all over. The sporangium-wall is usually double, but the two layers may be so closely united as to be inseparable.

In the writer's collection is a specimen collected at Arlington, Mass., showing a single sporangium-wall less densely charged with lime, but agreeing in every other respect with the Ouray gathering.

Under the name *P. testaceum* the writer also includes a specimen received from Mr. A. P. Morgan of Preston, Ohio, marked *Physarum concinnum, B. & C.,* and the *"Physarum Diderma, Rost."* of Macbride's North American Slime-Moulds. These two specimens consist of closely aggregated groups of sporangia with white, densely calcareous, outer walls. As pointed out by Lister (Journ. of Bot., June 1897, p. 212), the name *Diderma concinnum, B & C.* refers to *Chondrioderma radiatum, (L.) Rost.* Macbride's *P. Didcrma* appears to be a very different thing from Rostafinski's species as understood by Lister and from the specimens mentioned above (p. 18) under that name, with cylindrical sinuous plasmodiocarps. It is worth noting in this connection that a specimen received from Mr. N. L. Gardner of Berkeley, Cal., identical with *P. Diderma* as described above, was submitted by the writer to Prof. Macbride who confirmed the determination. If such specimens represent the true *P.*

Diderma, as Lister believes, it is difficult to include under that name the form described by Macbride. Finally, a number of specimens of *P. didermoides, var. lividum*, received from Mr. Lister, show the same divergences from *P. didermoides*, as do the American gatherings, and these specimens, as well as Morgan's *P. concinnum, (B. & C.)* and Macbride's *P. Diderma, Rost*, are therefore included under the name *Physarum testaceum, Sturgis.* Whether or not that name will stand depends on the stability of the spore-characters. Should future gatherings show that the unequal thickness of the spore-wall is a varying character and that in other respects *P. testaceum* approaches *P. lividum* too closely to be always distinguishable from it, the latter name must stand. But in any case, it seems fairly certain that this form can not be regarded as a variety of *P. didermoides.*

PHYSARUM PALLIDUM, *(B. & C.) List.* This rare but very characteristic species is represented by a single gathering obtained by Mr. Bethel at Tolland in October, 1906.

The name is based on two American specimens, one in the Kew Collection, from South Carolina, marked *Diderma pallidum, B. & C.;* the other in the British Museum Collection from Ravenel under the same name, (Lister in Journ. of Bot., April 1898, p. 5.). It is also the same *(teste* Lister, l. c., p. 10) as a specimen collected in Java by Raciborski and named by him *Physarum bogoriense, n. s.* Technically the latter name should be regarded as valid, since no description of their species was ever published by Berkeley and Curtis. But inasmuch as Berkeley *(Grevillea,* II. p. 52) refers to the specimen in the Kew Collection under the name *Diderma pallidum,* it seems advisable to retain that name. The species is related to *Physarum sinuosum* which it resembles in the shape of the plasmodiocarps and the manner of dehiscence. The outer wall, however, is smooth, of a brownish or tawny color, densely charged on its inner surface with white lime, and of a somewhat cartilaginous texture. The capillitium consists of numerous small, rounded, white lime-knots connected by long delicate threads. The spores are clear violet-brown in color, minutely spinulose, and measure 8-9 μ in diameter.

Inasmuch as *P. pallidum* has heretofore been reported only from Pennsylvania, the Southern States and the tropics, it is especially interesting to note its occurrence at high altitudes in Colorado.

PHYSARUM LATERITIUM, *(Berk. & Br.) Rost.* This species occurs only once in our Colorado gatherings, having been collected at Boulder by Mr. Bethel and the writer. The specimen resembles the descriptions of *Physarum rubiginosum, Fr.* in the elongated branching capillitial knots, but the single sporangium-wall heavily encrusted with brilliant orange-red deposits of lime, and the uniformly sessile habit, lead to its reference to the species quoted. It is the same as *P. inaequale, Pk.*, differing from typical specimens of that species only in the character of the lime-knots. A specimen received from the late Dr. G. A. Rex and compared by him with Peck's type shows rounded lime-knots, yellow, with red centres. In other specimens this bi-coloration is much less pronounced and the lime-knots are angular and branching. Macbride fails to see this feature in any of the specimens examined by him. The Boulder specimen shows a darker color in the centre of the lime-knots but it is apparently due merely to the greater density of the central portions of the knots, and not to the presence of amorphous plasmodic matter as in the case of the type-specimen of *P. inaequale,* (Cf. Sturgis, Trans. Conn. Acad. of Arts & Sc., Vol. x, p. 468). The double coloration therefore, can hardly be considered as a diagnostic feature.

PHYSARUM AURISCALPIUM, *Cke.* This species has been collected in small quantities at Palmer Lake and in the San Juan Mts., (Bethel); at Boulder, (Bethel & Sturgis); and near Colorado Springs, (Sturgis). Though varying much in habit, from long-stalked to sessile forms, it maintains its distinctive characters—the globose yellow sporangia; stalks, when present, brownish and translucent; capillitium of many branching yellow lime-knots; spores violet-brown, minutely warted.

PHYSARUM BERKELEYI, *Rost.* A gathering made near Colorado Springs in September, 1906 has been placed here, though it might, with almost equal propriety, be included under the preceding species. It is distinguished by the uniformly stipitate habit, the longer stalks, and the less abundant lime of the capillitium. (Cf. Lister, Journ. of Bot., April, 1898, p. 3.)

PHYSARUM NEWTONI, *Macbr.* This exquisite species, "easily recognized by its almost sessile, rose-purple, generally umbilicate sporangium," is described by Macbride (N. A. Slime Moulds, p. 37) from a single gathering collected in

Colorado by Prof. Newton. It has not been met with by the writer.

PHYSARUM CITRINUM, *Shumacher.* This species is reported from Colorado by Prof. Macbride *in litt.* Among the yellow, stipitate species of *Physarum* it is distinguished by its yellow stalk, charged throughout with lime, the yellow lime-knots of the capillitium, and the presence of a columella.

PHYSARUM COMPACTUM, *(Wing.) List.* The writer has not met with this species, but it is included in Prof. Macbride's MS. list of Colorado *Myxomycetes* referred to above

FULIGO, *Haller.*

FULIGO SEPTICA, *(L.) Gmel.* Common everywhere. Specimens, varying in color from pale yellow to brick-red and brown, are present from Arrowhead, Ouray, Pagosa, the South Platte, Tolland, Boulder, Golden and Palmer Lake, all collected by Mr. Bethel or the writer. The large size of the æthalia, the yellowish lime-knots, and the rather small, nearly smooth spores are characteristic features. Prof. Macbride writes *(in litt.)*, "A Colorado variety occurs with somewhat larger spores, 12-13 μ." This may referable to the following species. The specimens are difficult to preserve owing to the attacks of a small beetle of the genus *Enicmus.* Bisulphide of carbon has been found useful in reducing the damage done by this pest.

FULIGO ELLIPSOSPORA, *(Rost.) List.* To this species has been referred a single specimen collected by Mr. Bethel at Tolland. The pure white color of the large, much-weathered æthalium and of the capillitial knots, and the rather pale, violet-brown, minutely warted and usually oval spores, distinguish it from *F. septica.* The spores measure 13 x 11 μ.

CIENKOWSKIA, *Rostafinski.*

CIENKOWSKIA RETICULATA, *(Alb. & Schw.) Rost.* A remarkable species easily recognized by the creeping and amastomosing plasmodiocarps of a brownish color, marked with dull scarlet bosses. Two small specimens were collected by Mr. Bethel and the writer, at Boulder, in September, 1906.

CRATERIUM, *Trentepohl.*

CRATERIUM LEUCOCEPHALUM, *(Pers.) Ditm.* Widely distributed throughout the State. Reported from Boulder,

(Bethel & Sturgis); Tolland and Golden, (Bethel); Colorado Springs, (Sturgis). At Boulder it occurred in extraordinary abundance on dead leaves and twigs, in bramble-patches, often in company with *Didymium nigripes, Fr.*

CRATERIUM MINUTUM *(Leers) Fr.* This species was found in abundance at Boulder by Mr. Bethel and the writer in September, 1906, but has not been reported from elsewhere in the State. General usage would seem to warrant the adoption of the name *C. pedunculatum, Trent.*, for this species, but Fries (Syst. Myc. III, p. 151) writes *"Peziza minuta, Leers;* descriptio eximia," and though he adds "Medium inter *Cr. pedunculat.* et *Cr. leucocephalum*, verum abunde distinctum," yet his own description of *C. minutum* leaves no room to doubt that it is the same as the *C. pedunculatum* of Trentepohl. Where the law of priority is so plainly justified, it seems necessary to follow it.

LEOCARPUS, *Link.*

LEOCARPUS FRAGILIS, *(Dicks.) Rost.* Specimens of this striking species are present from Tolland and Palmer Lake, (Bethel); Glen Park and Colorado Springs, (Sturgis). The large, rich brown, highly polished sporangia can hardly be taken for anything else.

LEOCARPUS FULVUS, *Macbr.* This very rare species is represented by a single gathering made by Mr. Bethel in June 1896, "on living willow growing in snow at 11,000 ft. alt. Loveland Pass, Colo." It is well developed and presents the following characters.

Sporangia globose or turbinate, 0.8-1.2 mm. diam., gregarious or scattered, pale yellow or tawny, sessile or stalked. Stalks, when present, pale yellow, membranous, being merely extensions of the membranous hypothallus. Wall cartilaginous with scanty deposits of minute yellow lime-granules. Capillitium a dense mass of very delicate hyaline threads, expanded at the angles, the expansions occasionally filled with yellow lime. Spores dark purplish brown, spinulose, 11-12.5 μ diam. The double wall mentioned by Macbride (N. A. Slime-Moulds, p. 82) is not apparent in our specimen; otherwise it agrees perfectly with the description. Another specimen from Mr. Bethel marked *"Leocarpus. On leaves of Abies lasiocarpa, under willows at timber line, Yankee Doodle Lake, Sept. '06,"* may be this species, but it is so immature that the characters can not be made

out with certainty. The gross appearance is that of *Leocarpus fulvus.*

In this connection much interest attaches to two specimens in the writer's collection marked *Physarum albescens, Phillips,* and received some years ago from Mr. Harold Wingate of Philadelphia. One is from the Rex herbarium and was collected in Iowa by Mr. E. W. D. Holway. The other is from Ellis's herbarium and was collected by Mr. Langlois in Louisiana. The Louisiana specimen agrees in every detail with Macbride's *Leocarpus fulvus.* The Iowa specimen is the same, except that the sporangia are more uniformly sessile and the spores are pale violet-brown, minutely warted, and measure only 8.6-9 μ in diameter. The capillitium, too, shows more abundant lime-knots. There can be no doubt, however, that they are both the same thing and that they are identical with Macbride's *Leocarpus.* If the origin of the name *Physarum albescens, Phill.* could be traced, it would take precedence of the name given by Macbride, but no mention of it can be found in the literature of the subject. So far, therefore, as the literature is concerned, it is a *nomen nudum,* but the fact remains that there are specimens bearing the name *Physarum albescens, Phill.* We leave it to experts to decide which name should be adopted, but we mark the Iowa and Louisiana specimens *Leocarpus fulvus, Macbr.*

DIDERMA, *Persoon.*

DIDERMA STELLARE, *(Schrad.) Pers.* This species occurs abundantly on decayed cottonwood. Specimens have been received from Tolland and Palmer Lake, (Bethel); Glen Park and Colorado Springs, (Sturgis); Boulder, (Bethel & Sturgis). The short-stipitate, rarely sessile sporangia, ashen or pale brown in color and marked with paler lines of dehiscence; and the stout, usually pale stalk, serve to mark the species. As to the specific name, *radiatum* seems to be properly excluded (cf. Macbride, N. A. Slime-Moulds, p. 105). Schrader's description and figures of *Didymium stellare* may, without too severe a strain upon the imagination, be taken to refer to the species under consideration, and that name is therefore adopted here.

DIDERMA SPUMARIOIDES. *Fr.* This species is fairly common, forming an effused whitish crust on dead leaves, grasses, &c. The white plasmodium often creeps up on living grass-stems and forms sporangia at a height of several inches above the ground.

Reported from Boulder, and the San Juan Mts., (Bethel), and from Glen Park, (Sturgis).

DIDERMA MICHELII, *(Lib.)* A rare species reported but once from Colorado. It was collected by Mr. Bethel at Aurora in August, 1906. The discoid sporangia with pure white fragile outer wall and flattened or almost obsolete columella of a pinkish brown color are its distinguishing characteristics. The Aurora gathering shows usually sessile sporangia; here and there however, occur sporangia with short, stout, yellowish stalks.

The synonomy of the species is perplexing. Bulliard (Hist. des Champ, de Fr., I, p. 93, Pl. 446, fig. 1) describes and figures *Reticularia hemisphærica,* but gives the color of the sporangia as "brun-noiratre." Sowerby (English Fungi, Pl. 12) gives an admirable figure of our species under the name *Reticularia hemisphærica, Bull.,* but Rostafinski, giving the synonomy of his *Chondrioderma Michelii,* writes *"Reticularia hemisphærica, Sow. non Bull.,"* and refers Bulliards figures to species of *Didymium* (Mon. pp. 172 and 386). Libert issued specimens of *Didymium Michelii* and Corda (Icon. Fung. v. p. 57, Taf. III, fig. 33) describes what is unquestionably the form under consideration and refers to Libert's specimens. The validity of the specific name *Michelii* therefore, rests upon actual specimens as well as upon excellent descriptions and figures, while a considerable degree of doubt exists regarding the form described by Bulliard under the specific name *hemisphærica.*

DIDERMA TREVELYANI, *(Grev.) Fr.* This species is reported from Colorado by Macbride, and it occurs in our collection, specimens having been found at Golden and Boulder by Mr. Bethel. It is characterized by sub-ovoid sporangia of a yellowish brown color marked by pale lines of dehiscence extending from the apex to the base. At maturity the wall splits open in revolute lobes exposing the inner surface which is white from the prescence of coarse crystalline masses of lime. The stalks are short and brown, and there is no columella.

DIDERMA TESTACEUM, *(Schrad.) Pers.* A single small gathering made by the writer near Colorado Springs in September, 1906, has been somewhat doubtfully refered to this common species. The sessile sporangia are more depressed than usual and are pure white instead of flesh-colored, thus resembling sessile forms of *D. Michelii,* but on the whole it seems referable to the species quoted.

DIDERMA GLOBOSUM, *Pers.* This species was found in a rather immature condition at Boulder by Mr. Bethel and the writer. The poorly developed, dirty-white sporangia are seated upon a densely calcareous, concolorous hypothallus. The dark spores measure 12.5 μ in diameter.

Prof. Macbride lists *Diderma crustaceum, Pk.* from Colorado. In the writer's opinion this is the same as *Diderma globosum.* (See Trans. Conn. Acad. Arts, Sc. Vol. x, p. 473).

DIDERMA NIVEUM, *(Rost.) Macbr.* This rare species is represented by a single specimen collected by Mr. Bethel, submitted to Prof. Macbride and marked by him "*Diderma Lyallii, Mass.*, Colo. '02." The specimen consists of a cluster of 40-50 large subglobose sporangia sessile upon or rising on delicate whitish stalks from a membranous, rather scanty hypothallus. The sporangium-wall is white and shows a yellowish inner wall. The columella is pale brown and prominent. The capillitium consists of coarse brown threads with paler tips. The spores are very dark and spinulose, and measure 12.5-14.5 μ diam.

Under date of Oct. 30th, 1905 Mr. Lister writes, regarding a collection of Myxomycetes gathered in Switzerland by Miss Lister. "Also *Chondrioderma Lyallii, Mass.* in interesting variety, showing that it is the same species as Rostafinski's *Chondrioderma niveum.* It was found in several places at the Bel Alp close to the melting snow; some of it exactly matching with the type of *C. niveum* in the Strassburg collection marked '*neben der schmeltzenden Schnee*'—some with densely calcareous sporangium-wall, and others *black* without lime."

DIDERMA SAUTERI, *(Rost.) Macbr.* Prof. Macbride records this species as occurring in Colorado. It is not included in our collection.

DIACHAEA, *Fries.*

DIACHAEA LEUCOPODA, *(Bull.) Fr.* Very abundant locally at Boulder, covering dead leaves over a large area, in shady thickets.

DIDYMIUM, *Schrader.*

DIDYMIUM FARINACEUM, *Schrad.* This and the next species are mong the most common of Colorado *Myxomycetes. D. farinaceum* is readily recognized by its crystalline wall, and its dark brown stalk and columella.

Specimens are before us from Colorado Springs, (Sturgis); Boulder, (Bethel & Sturgis); and Tolland, (Bethel).

DIDYMIUM SQUAMULOSUM, *(Alb. & Schw.) Fr.* Abundant throughout the State in favorable situations; Boulder, Denver, Fort Collins, Aurora, Tolland, (Bethel); Colorado Springs, (Sturgis). The stipitate forms resemble *D. farinaceum*, but differ in the snow-white stalk and columella. Sessile forms with globose sporangia and very dark spores measuring 10.5-12 μ are frequently met with. The Aurora specimen is of this type and closely approaches *D. crustaceum.*

DIDYMIUM SQUAMULOSUM, *var.* CLAVIFORME, *n. var. Sporangia stipitate, disc-shaped,* 0.4-0.5 *mm. diam.,* 0.2 *mm. or less thick, snow-white, rugose, deeply umbilicate and yellowish beneath, umbilicate above. Stalk* 0.3-0.5 *mm. long, white, furrowed. Columella hemispherical or depressed, white. Capillitium of delicate, flexuous, hyaline threads, with occasional small fusiform expansions. Spores* 9-12 μ *diam., rather dark violet-brown, irregularly warted.*

On dry fruits of Echinocystis lobata. Bethel leg., Denver, Colo., September, 1906.

This form resembles a minute *Didymium Clavus*, from which however, it is distinguished by the presence of a columella and the character of the spores. From all normal forms of *D. squamlosum* it differs in the shape of the sporangia, while agreeing with that species in all other respects. The spores are peculiar in their marking, the minute warts being here and there collected in small clusters as in *Comatricha typhoides.*

DIDYMIUM ANELLUS. *Morg.* ("The Myxomycetes of the Miami Valley, Ohio," p. 64, 1894). This extremely delicate and characteristic species was found by Mr. Bethel at Boulder in September 1906, growing upon dead leaves. A little later the present writer collected it near Colorado Springs, on the inner bark of decayed cottonwood logs, in company with *Perichæna corticalis, (Batsch) Rost.*

Morgan describes the species perfectly, as follows:

"Plasmodiocarp in small rings or links, then confluent and elongated, irregularly connected together, bent and flexuous, resting on a thin venulose hypothallus; the wall firm, dark-colored, with a thin layer of stellate crystals of lime, irregularly ruptured. Columella merely a thin layer of brown scales. Capillitium of slender, dark-colored threads which

extend from base to wall, more or less branched, and combined into a loose net. Spores globose, very minutely warted, violaceous, 8-9 mic. in diameter."

The Boulder specimen corresponds in every respect with this description. Those from Colorado Springs are in the form of extremely thin grayish crusts, the plasmodiocarps being only indicated by depressions in the surface. The capillitium threads are straighter and coarser than in the Boulder gathering, and the spores are darker and larger, measuring 12-13 μ diam. Occasionally distinct sporangia occur in the Boulder gathering, but they are always sessile, much flattened and often umbilicate above or even annulate.

Lister (Journ. of Bot., June, 1897, p. 214 and April, 1899, p. 5) described this form under the name *Didymium effusum, Link, var. tenue, List.* It seems however, to be abundantly worthy of specific rank and Morgan's name takes precedence.

. DIDYMIUM NIGRIPES, *(Link) Fr.* A single small and poorly developed specimen collected by the writer near Colorado Springs represents the typical form of this species, with dark brown stalk and columella.

The common form in Colorado is the *var. eximium, (Pk.) List., (Didymium eximium, Pk).* This has been collected in quantity at Colorado Springs, (Bethel & Sturgis), and at Bouder, (Bethel). It shows irregularly globose sporangia of a yellowish gray color, a large pale brown columella, and capillitium of pale, branching and anastomosing threads, expanded toward the surface of the columella and showing here and there fusiform expansions with yellowish contents. The spores average 9 μ in diameter. The writer's reasons for following Lister in making this form a variety of *D. nigripes*, have been sufficiently stated elsewhere. (Trans. Conn. Acad. Arts & Sc., Vol. x, p. 478 e. s.)

DIDYMIUM DIFFORME, *(Pers.) Duby.* This species is readily distinguished by its much appressed sporangia or plasmodiocarps, with smooth, fragile, white walls, the lime being in the form of crystalline masses, not in spherical granules as in the genus *Diderma.* It is represented in our collection by specimens gathered at Denver by Mr. Bethel, on dead leaves and twigs and on bits of glass.

DIDYMIUM CLAVUS, *(Alb. & Schw.) Rab.* Listed by Macbride (in MS.) as a Colorado species. It is not represented in our collection.

SPUMARIA, *Persoon.*

SPUMARIA ALBA, *(Bull.) DC.* This occurs in abundance and in extraordinarily varied forms. At Boulder the normal form was found, with ragged æthalia forming on grass-stalks and on the stems of shrubby plants. At Pagosa Springs and again at Palmer Lake a form occurs in abundance in which the sporangia are less closely associated and are seated upon a dense white hypothallus forming a crust upon wood and only occasionally on twigs and grass-stems. But the most remarkable forms are represented by specimens gathered at Boulder and Denver by Mr. Bethel. At first sight they would unhesitatingly be placed under *Fuligo septica,* judging only by the habit and gross appearance. They occur uniformly on the bark of fallen logs, usually of cottonwood, and are in the form of massive æthalia often 4-5 cm. in diameter and 2-2.5 cm. in thickness, covered with a very thick crust of cream-white lime which is either spongy in appearance or smoother and pulverulent, as though the spongy crust had been rubbed down with the finger. Sometimes the spongy crust falls away in large flakes exposing the pulverulent layer beneath. In these cases the lime is in minute crystals combined into small masses. Again the æthalia are flatter and cake-like, covered with a dense white coating of lime but very solid in texture beneath, the sporangia being inextricably intertwined. Such specimens are usually found growing in company with the flat purplish æthalia of *Fuligo cllipsospora,* often so intimately as to be partially superimposed. There is undoubtedly an extreme divergence in both appearance and structure between these massive forms and the effused forms collected at Pagosa Springs and elsewhere in which the separate sporangia occur in a single layer and are plainly distiguishable. The capillitium of the former also differs markedly from that of normal *S. alba* and the spores are smaller. On the whole it seems advisable to consider this as a well-marked variety, and it is so designated, as follows.

SPUMARIA ALBA, *var.* SOLIDA[x] *n. var. Plasmodium milk-white. Æthalia massive, 4-5 cm. in diameter, 1-2.5 cm. thick, covered with a very thick spongy or pulverulent coating of cream-white lime; the lime usually in the form of small, crystalline masses. Capillitium scanty, of delicate, hyaline, anastomosing threads, with occasional fusiform expansions filled with dark matter. Spores, dark purplish*

x A very distinct species not at all like S. alba. The plasmodium (which S. never has) is as different as the Sporogonium of a Fern.

brown, rather minutely spinulose, 8-11 μ *diam. On the outer bark of fallen cottonwood logs. Denver, Boulder and Palmer Lake, (Bethel), May to September,* 1906.

STEMONITIS, *Gleditsch.*

STEMONITIS FUSCA, *Roth.* We here place the common dusky or smoky-brown form, with more or less reticulated spores, so common in this country. Macbride ("Slime-Moulds," p. 115) characterizes this species as having spores "smooth or more or less warted, but not reticulate," and applies the name *S. maxima, Schw.* to the common form with reticulate spores. The late Dr. Rex distributed specimens (Ell. & Ev. N. A. F. 2697) labelled "*Stemonitis maxima, Schw.*, Compared with the type in Herb. Schw." These have reticulated spores.*

There is no question therefore, about the spores of the Schweinitz species. Of Roth's species there is, so far as is known, no type in existence, and we have to fall back on Rostafinski. Macbride writes (l. c.) "Specimens identified by Rostafiinski in 1875 as *S. fusca* have the spores slightly warted when viewed under a Zeiss 1-12." What these specimens are we do not know, but in what we call *S. fusca* the reticulation shows much variation and it is very doubtful whether Rostafinski would have been able to distinguish between a punctate reticulation and a minute, even warfing of the surface. Moreover according to Lister (Mon. p. 111) Rostafinski's specimens of *S. fusca* in the British Museum and the Strassburg Museum, have faintly reticulated spores. In correspondence with the writer Mr. Lister also says "There are more than 20 specimens marked *S. fusca* in the Kew and British Museum collections, examined by Rostafinski; all of these have reticulated spores." As noted above, it is highly improbable that Rostafinski would have been able, with the lenses at his command, to recognize a more or less faint and broken reticulation; in fact he describes the spores of his specimens as smooth when we now know that they are reticulated. When, in addition, a large number of specimens marked *S. fusca* and which were examined by Rostafinski, are found to have reticulated

* There is another specimen (No. 1119) in the same collection, labeled *Stemonitis fusca, Roth*, collected by Dr. Rex This has spores showing a broken punctate reticulation. In the box containing this specimen there is, at least in the writer's set, a fine specimen of *Comatricha heterospora*, Rex. The non-identity of the two specimens was evidently overlooked by Dr. Rex.

spores, we are surely justified in placing specimens showing this character under the name *S. fusca.* What to do with the somewhat similar form, with smooth or faintly and evenly warted spores, is another question. Lister calls it *S. splendens, Rost.* It is rare in Europe, but occurs, commonly in this country.

In connection with normal *S. fusca,* mention should be made of certain specimens collected at Boulder by Mr. Bethel and the writer in October, 1906. They show small clusters of purplish or reddish brown sporangia, cylindrical, 2-3.5 mm. in height and very short-stalked, rising from a thin hypothallus. The capillitium shows an imperfect surface-net with many long free tips, especially toward the apex of the sporangium. The spores are rather pale reddish-brown and appear smooth; under a Leitz 1-12 however, a faint reticulation can be seen. They measure 8-9 μ in diameter. These specimens very closely resemble *Comatricha heterospora, Rex (C. typhoides, var. heterospora* of Lister's Monograph), their only distinguishing feature being the large spores. They belong undoubtedly to Lister's *var. rufescens* of *Stemontis fusca,* and serve to show how closely connected are the genera *Stemonitis* and *Comatricha.*

S. fusca, Roth, as defined above, occurs in our Colorado collection from Tolland, (Bethel); Boulder, (Bethel & Sturgis,) and Glen Park, (Sturgis).

STEMONITIS SPLENDENS, *Rost.* This species closely resembles the preceding, but is distinguished from it by the nearly smooth or minutely and evenly warted spores. It is frequently found on the edges of board-walks and on railway ties. It has been found at Denver, Palmer Lake, Boulder and Ouray, (Bethel). Specimens from Palmer Lake and Boulder show Lister's *var. flaccida,* with adherent sporangia, capillitium without a surface-net and with remnants of the sporangium-wall in the shape of pale brown flakes. The *var. confluens* has been found at Denver, though in poor condition.

STEMONITIS HERBATICA, *Pk.* This name rather represents a convenient centre, around which to group forms not easily referable elsewhere, than a species with definite limits. In a previous paper (Trans. Conn. Acad. of Arts and Sc., Vol. x, p. 482) the writer, after examining Peck's type of *S. herbatica,* said "I cannot with any certainty distinguish between *S. herbatica, Pk.* and *S. ferruginea, Ehr.*" This statement still expresses the writer's opinion. Nevertheless,

though the two species are connected by many intergrading forms, it seems convenient to make a distinction between them as centres. In a general way what we call *S. herbatica* is distinguished by its color, neither as dark and purplish as *S. fusca* and *S. maxima* nor as ferruginous as *S. ferruginea*. The surface-net is composed of small meshes but they are neither as small nor as pale as in *S. ferruginea*, and the spores (7.5-8 μ diam.) are rather larger and darker than those of *S. ferruginea*. Specimens are before us from Colorado Springs, (Shantz); Tolland, the San Juan Mts., Glen Park and Boulder, (Bethel).

STEMONITIS FERRUGINEA, *Ehr.?* In a recent paper (Abhandl. d. Bot. Vereins d. Prov. Brandenburg, XLV, p. 164) Dr. E. Jahn publishes the results of his studies of the ferruginous species of *Stemonitis*. Two forms are recognized, distinguished by the color of the plasmodium. One has a *white* plasmodium and includes *S. ferruginea, Ehr., S. microspora, List.*, and *S. Smithii, Macbr.* The other has a *yellow* plasmodium and to this form Jahn gives the name *S. flavogenita*. It includes the form called by Fries *S. ferruginea*, since that form had *(teste* Fries) a yellow plasmodium. If we accept Jahn's conclusions it is evidently necessary to know the color of the plasmodium before we can decide with certainty whether our common ferruginous species is really, as it has always been called, *S. ferruginea, Ehr. (S. Smithii, Macbr.)* or whether we have to do with Jahn's *S. flavogenita*. The size of the spores does however, furnish another, though not always very reliable, clue to the species, those of *S. ferruginea* being somewhat the smaller. Mr. Lister, who has made a careful comparative study of these two forms and the related *S. herbatica Pk.* suggests *(in litt.)* the following key.

	Spores	Plasmodium	Surface-net
S. ferruginea, Ehr. *syn. S. microspora, List.* *S. Smithii, Macbr.*	4-5 μ rusty	White or white with a green tinge	Usually firm and close
S. flavogenita, Jahn. *syn. S. ferruginea, Fr.*	6-8 μ rusty	Translucent Citron-yellow	Delicate, not very close
S. herbatica, Pk.	6.5-8 μ pale purplish gray.	White, cream- color, lemon yellow	Usually firm

Whether future investigations will justify the above scheme, remains to be seen. The whole subject is a confused and difficult one. We have here placed under the

name *S. ferruginea* specimens from Boulder, (Bethel & Sturgis); Colorado Springs, (Sturgis); Tolland and the San Juan Mts., (Bethel). They are all ferruginous in color, but the size of the spores varies. In some they measure 4.5 μ diam., in others as high as 6.5 μ. There is also great variation in stature, from 4 mm. to 1.5 cm. If *S. Smithii, Macbr.* is recognized as a species distinct from *S. ferruginea, Ehr.*, the larger forms might be placed under the former name.

COMATRICHA, *Preuss.*

COMATRICHIA NIGRA, *(Pers.) Schroet.* The common form of this species—the only one recognized by Macbride as rightly belonging under this name—occurs abundantly throughout Colorado. It is usually found on coniferous wood and is easily recognized by its more or less globose or ovoid sporangia erect on long delicate stalks. Mr. Bethel has collected it in abundance at Palmer Lake, Tolland, Denver, Ouray, and Boulder. It occurs also in the neighborhood of Colorado Springs, (Sturgis). Specimens gathered on Pike's Peak by Mr. Shantz show exceptionally long stalks, and sporangia larger and darker in color than usual.

* *var.* SUKSDORFII, *Ell. & Ev. (ut. sp.).* This form is apparently common. Our collection includes specimens from Tolland, Arrowhead, Granby and Yankee Doodle Lake, all gathered by Mr. Bethel. In its typical form it bears little resemblance to the species, showing a densely gregarious habit, elongate-ovoid sporangia almost black in color, very short stalks, dense and dark capillitium, and dark spores 10-11 μ in diameter. Other gatherings, however, show the sporangia scattered, more or less globose, mounted on stalks equalling or exceeding the height of the sporangia, and with large spores (10-13 μ diam.). Such specimens vary in color from grayish to almost black, in the latter case bearing a very close outward resemblance to *Lamproderma* or even *Enerthenema*. Intermingled with these are often found forms quite indistinguishable from typical *C. nigra*, so that the gatherings show every gradation between that species and *C. Suksdorfii*. With only the two extremes of this series in mind, Macbride accords specific rank to both. Lister, on the other hand, emphasizing the connecting links in the series, refuses even varietal rank to *C. Suksdorfii*. In the writer's opinion, convenience seems to warrant some sort of distinction between the two extremes of such a series, while

C. Suksdorfii is a well defined + distinct species as found in Colo. Oregon + Washington States, never a var. the true C. Suksdorfii, but quite that some large specimens of C. nigra are this. Lister Macbride is correct

not losing sight of their manifest relationship. The name *Suksdorfii* is therefore given varietal rank.

var. AEQUALIS, *Pk., (ut sp.).* As in the preceding case, Macbride retains this name as applying to a distinct species, while Lister merges it with *C. nigra.* Only one specimen has been collected in Colorado. It was found by Mr. Bethel at Boulder. Most of the sporangia are of the typical cylindrical shape and large size, but they vary much in size, the smaller ones being identical with robust forms of *C. nigra.* The examination of a large series of specimens, including Peck's type, leads the writer to regard *C. aequalis* as merely a well-marked variety of *C. nigra.*

COMATRICHIA LAXA, *Rost.* Except for its lax and rather open capillitium, this species closely resembles small, erect forms of *C. nigra.* Mr. Bethel has collected it at Boulder, Tolland, Aurora and Mammoth.

COMATRICHA TYPHINA *(Wigg.) Rost.* Among the cylindrical forms of *Comatricha,* this species is readily recognized by its small, pale spores, almost smooth except for a few small clusters of minute papillæ. Occasionally these clusters or warts are connected by a delicate broken reticulation, and in rare cases the reticulation alone is present with no sign of the warts. To specimens exhibiting such reticulated spores Rex gave the varietal name *heterospora.*

Both the species itself and its variety (the latter predominating) have been collected at Glen Park, (Sturgis); Boulder, (Bethel & Sturgis); Palmer Lake, Tolland, Ouray, and the San Juan Mts., (Bethel).

COMATRICHIA IRREGULARIS, Rex. This species, easily mistakable for a *Stemonitis,* occurred abundantly in August, 1906, at Boulder on fallen logs of cottonwood. The densely gregarious, purplish black sporangia are characteristic. Specimens have also been receivel from Fort Collins.

COMATRICHA PERSOONII, *Rost.* A single gathering of this rather uncommon species was made by Mr. Bethel in the San Juan Mts., in July, '97. The small, reddish-brown, cylindrical or ovoid sporangia were found in some abundance on dead leaves.

ENERTHENEMA, *Bowman.*

ENERTHENEMA PAPILLATA, *(Pers.) Rost.* Occurs rather rarely and in small quantity. Specimens are present from near Colorado Springs, (Shantz, Sturgis); Boulder and Tolland, (Bethel).

LAMPRODERMA, *Rostafinski.*

LAMPRODERMA VIOLACEUM, *(Fr.) Rost.* Only two specimens of this species occur in our collection, one from Ouray, (Bethel), the other, also collected by Mr. Bethel, but only labelled "Colorado, '02." They are both very scanty. The species is undoubtedly rare.

LAMPRODERMA SAUTERI, *Rost.* By Lister this is regarded as a variety of the preceding species. Macbride regards it as specifically distinct, and with this view the writer is inclined to agree. The persistent base of the sporangium-wall, the more regular capillitium with very delicate hyaline tips, and especially the larger, rougher spores, seem to differentiate it from *L. violaceum.* We have but one specimen from Colorado. This was collected by Mr. Bethel in 1902, but the exact locality is not noted.

LINDBLADIA, *Fries.*

LINDBLADIA EFFUSA, *(Ehr.) Rost.* Mr. Bethel has collected this species twice, at Palmer Lake and at Golden. Both specimens are in the form of an effused one or two-layered crust of delicate, closely aggregated sessile sporangia.

CRIBRARIA, *Persoon.*

CRIBRARIA ARGILLACEA, *Pers.* Fairly common. Specimens are present from Glen Park, (Sturgis); Boulder, (Bethel & Sturgis); Tolland, (Bethel). Some of the Boulder specimens are of peculiar interest as exhibiting the close relationship existing between this species and the *var. simplex* of *Lindbladia effusa;* indeed the two genera intermingle at this common point.

CRIBRARIA MINUTISSIMA, *Schw.* This species is usually found abundantly when once seen, but its mintue size renders it liable to be overlooked. It has been collected in the mountains near Colorado Springs, (Shantz and Sturgis); and at Boulder, (Bethel). It is probably very widely disseminated in mountainous regions.

CRIBRARIA MACROCARPA, *Schrad.* A single gathering of this species was made by the writer at Glen Park, in August, 1905.

CRIBRARIA AURANTIACA, *Schrad.* Found in small quantity by the writer at Glen Park, and by Mr. Shantz in the neighborhood of Colorado Springs.

CRIBRARIA INTRICATA, *Schrad.* In the MS. list of Colorado *Myxomycetes* referred to above, Prof. Macbride includes this species, under the name *C. dictydioides, Cke. & Balf.* In the present writer's opinion these two species are identical. This opinion was shared by the late Dr. Rex who wrote, *(in litt., Feb. 22nd, 1893), "C. intricata* and *C. dictydioides* are undoubtedly the same, the size or absence of the calyculus having no specific value." Lister (Mon. p. 144) places the latter as a variety of *C. intricata.*

CRIBRARIA ELEGANS, *B. & C.* Prof. Macbride also lists this species as a Colorado form. It is not included in our collection.

CRIBRARIA VIOLACEA, *Rex.* Probably rare, though liable to escape observation owing to its minute size and dark color. The writer obtained it in considerable quantity on the inner bark of cottonwood logs in a damp cañon near Colorado Springs, September, 1906.

DICTYDIUM, *Schrader.*

DICTYDIUM CANCELLATUM, *(Batsch) Macbr.* Common everywhere; Denver, Golden, Tolland, Arrowhead, on the South Platte and in the San Juan Mts., (Bethel); Colorado Springs, (Shantz); Manitou Park and Glen Park, (Sturgis). The specimens from Glen Park frequently show the abnormal form called by Rostafinski *Heterodictyon,* the sporangium-wall, especially in the upper part, showing an irregular net with large, angular nodes, closely resembling *Cribraria.* Below, the strong ribs connected by delicate parallel threads, are usually apparent. The spores too, are identical with those of *Dictydium.*

TUBULINA, *Persoon.*

TUBULINA CYLINDRICA, *(Bull.) Rost.* Collected in small quantities at Tolland and on the South Platte, (Bethel), and at Glen Park, (Sturgis). The synonomy of the species is so hopelessly confused and the earlier observers were so little able to distinguish between this and forms resembling it in outward appearance, that it seems permissible in this case to ignore rules of strict priority and to use the name selected by Rostafinski.

DICTYDIÆTHALIUM, *Rostafinski.*

DICTYDIÆTHALIUM PLUMBEUM, *(Schum.) Rost.* This peculiar species, with its extremely appressed æthalia, ap-

pears to be rather rare. Specimens are before us from Palmer Lake and Boulder, both collected by Mr. Bethel. One other specimen, also collected by Mr. Bethel, but with no locality other than "Colorado", shows a marked divergence from the normal form, in that the threads representing the angles of the contiguous sporangia are, in most cases, more or less connected by delicate cross-ribs. The normal form also occurs in the same specimen.

ENTERIDIUM, *Ehrenberg.*

ENTERIDIUM OLIVACEUM, *Ehr.* A single specimen of this rare species was collected by Mr. Bethel at Palmer Lake in June, 1901. It is in the form of a thin, effused æthalium, 3 cm. long and about 1.5 cm. wide. The clustered spores and the appressed form of the æthalium distinguish it from the following species.

ENTERIDIUM ROZEANUM, *Wing.* Our collection contains two specimens of this species, both collected by Mr. Bethel. One of these was collected at Boulder, and is in the form of a pulvinate æthalium, 3 cm. in diameter. The other bears merely the locality-label "Colorado, '02." It is a very large æthalium, 6 x 3 cm., and with a firm, brown, outer crust.

Prof. Macbride, (N. A. Slime Moulds, p. 151), substitutes for the specific name *Rozeanum*, the name *splendens* given to this species by Morgan, on the ground that the specimens on which Wingate based the specific name given by him "are no longer to be consulted." Mr. Wingate, a most accurate observer, satisfied himself that certain European specimens collected by Roze were identical with our American species of *Enteridium*, and named them *E. Rozeanum*. Inability to verify Wingate's conclusions should not invalidate the name which he gave.

RETICULARIA, *Bulliard.*

RETICULARIA LYCOPERDON, *Bull.* This species appears to be common throughout the State and often attains a very large size, four to five inches in diameter. It occurs frequently on decorticated portions of living trees and, with its silvery-white cortex, forms a very conspicuous object.

TRICHIA, *Haller.*

TRICHIA PERSIMILIS, *Karst.* This and the next following species are among the most conspicuous of the *Myxo-*

mycetes, owing to their abundant and closely crowded sporangia and their brilliant yellow color. *T. persimilis* is represented in our collection by specimens from the San Juan Mts., the South Platte and Ouray, (Bethel); and from Glen Park, (Sturgis).

TRICHIA AFFINIS, *DBy.* Hardly to be distinguished from the preceding species; indeed Macbride unites the two under the name *T. persimilis.* The somewhat paler, brighter color of the sporangia in *T. affinis* and the more complete reticulation of the spore-sculpture are fairly constant features and serve to differentiate it from *T. persimilis.* All of our specimens are from the San Juan Mts. and were collected by Mr. Bethel.

TRICHIA CONTORTA, *Rost.*

var. INCONSPICUA, *Rost.* Common on the inner bark of Box Elder, throughout the State. Specimens are before us from Colorado Springs, (Sturgis); Fort Collins, (Bragg); Silver Lake, (Watts); Ouray, Boulder and Denver, (Bethel). Mr. Bethel describes the plasmodium as "light pink turning yellow, then black."

Macbride follows Rostafinski in separating *T. inconspicua* from *T. contorta* on the ground of the less aggregate habit of the latter and its irregular capillitium; but considering the variability of these characters in all of the *Trichiaceæ*, they can not, in the present writer's opinion, be regarded as distinctive features. In the specimens before us sporangia are found in which the elaters are combined to form a net, and are irregular with bulbous expansions, the spirals inconspicuous or wanting; while in other cases, sometimes even in the same colony, the separate elaters are regularly cylindrical, and show distinct and even spirals and bulbous or evenly tapering tips. The character of the elaters seems dependent on the conditions during development rather than on any specific differences.

TRICHIA FALLAX, *Pers.* Very common and readily recognized by its usually gregarious habit and its stipitate, turbinate sporangia. Not infrequently the elaters are branched and even tend to form a net as in the genus *Hemitrichia.* Found in abundance at Colorado Springs and Glen Park, (Sturgis); Breckenridge, Tolland, Yankee Doodle Lake and in the San Juan Mts., (Bethel).

Macbride (N. A. Slime-Moulds, p. 218) writes "*T. decipiens (Pers.)*" This name antedates "*fallax*" by a year,

but the latter has the sanction of universal usage for a century and may well be allowed to stand.

TRICHIA VARIA, *(Pers.) Rost.* Common everywhere. Distinguished, among the species with papillate spores, by its elaters which are marked with only two loose spirals.

Colorado Springs, (Sturgis); Denver, Boulder and Ouray, (Bethel).

TRICHIA BOTRYTIS, *(Pers.)* This is apparently a rather rare species in Colorado. A single, scanty gathering was made by the writer near Colorado Springs in September, 1906. The scattered sporangia are turbinate and of a dark olivaceous brown color, marked with paler lines of dehiscence; the elaters and spores are dull yellow.

HEMITRICHIA, *Rostafinski.*

HEMITRICHIA CLAVATA, *(Pers.) Rost.* The specimens of this common species contained in our collection are remarkable for the varying features which they exhibit. Externally they are of the familiar type; stalked sporangia, turbinate in shape and of a bright, shining, yellow color. A large gathering made by the writer and Mr. Bethel at Boulder in August, 1906, exhibits marked peculiarities in its minute features. The threads of the capillitium, instead of being spirally banded as usual, are, minutely and densely spinulose; the spores are also abnormal, being marked with a very delicate and incomplete reticulation. We should be inclined to make this gathering the basis of a new variety, were it not that other specimens from the same locality show only the one abnormality of reticulated spores. Others again, also with normal capillitium, show spores either smooth, or minutely warted, or reticulated, from sporangia otherwise normal and in the same colony.

Specimens are present from Boulder, (Bethel & Sturgis); Ouray, Tolland, and Arrowhead, (Bethel).

HEMITRICHIA OVATA, *(Pers.) Macbr.* This is the *H. Wigandii* of Rostafinski and of Lister's Monograph. Why the former abandoned the name given by Persoon is not apparent. (Cf. Macbride, N. A. Slime-Moulds, p. 203.). The species is not common, though fairly widely distributed. Specimens are present from Colorado Springs, (Sturgis, Shantz); Palmer Lake, Ouray and Yankee Doodle Lake, (Bethel).

ARCYRIA, *Hill.*

ARCYRIA INCARNATA, *Pers.* A fairly common species distinguished by its pinkish color and the loose attachment of the capillitium to the calyculus. Frequently the whole capillitium is blown or weathered away, leaving only the stalks and empty cup-like bases of the sporangia. The capillitium of this species exhibits a certain degree of variation in its markings. Normally the latter are in the form of cogs, transverse ridges or partial rings, but occasionally specimens occur in which the capillitium is minutely spinulose throughout.

Represented in our collection by specimens from Colorado Springs, (Sturgis, Shantz, Hall); Boulder and Tolland, (Bethel).

ARCYRIA PUNICEA, *Pers.* This is hardly more than a variety, and not a very well marked variety at that, of the preceding species, distinguished chiefly by the character of the capillitium which is more firmly attached to the calyculus and shows very few, if any, loose ends. Both species show a tendency to change color, after maturity, to dull brown. In Colorado *A. punicea* seems to be less common than *A. incarnata*, only scanty specimens being present from Colorado Springs, (Sturgis) and the San Juan Mts., (Bethel).

ARCYRIA POMIFORMIS, *(Leers.) Rost.* This minute species is easily recognized by its scattered, globose, dull yellow, shortly stipitate sporangia. It appears to be fairly common, but does not occur anywhere in great abundance and easily escapes notice. Mr. Lister considers it to be a variety of *A. cinerea, (Bull.) Pers.* (*A. albida, Pers.*), but the features in which it differs from that species are so constant that it seems advisable to regard them as specific even though there may be intermediate forms. Certainly our specimens from Colorado are as distinct as two species could well be, and show no connecting forms.

The present species is represented by specimens from Colorado Springs, (Shantz); Glen Park, (Sturgis); Boulder, (Bethel & Sturgis); Ouray and Denver, (Bethel).

ARCYRIA CINEREA, *(Bull.) Pers.* Specimens are before us from Glen Park, (Sturgis); Colorado Springs, (Shantz); Boulder, (Bethel). They are of the normal type, pale gray sporangia, cylindrical, short-stalked, and either scattered or gregarious.

ARCYRIA STIPATA, *(Schw.) List.* This species is evidently rare in Colorado for, notwithstanding its conspicuous habit, it is represented in our collection by only a single specimen collected by Mr. Bethel and marked "Colo. '02." The original carmine-brown color has faded to a dull brown, but the densely crowded, short-stalked sporangia, and the triangular capillitium-threads marked on the edges with blunt cogs and throughout with faint spirals, are characteristic features. Macbride refers this species to the genus *Hemitrichia* because of the spiral markings on the capillitium. It is certainly a connecting link between that genus and *Arcyria.*

ARCYRIA NUTANS, *(Bull.) Grev.* This is the commonest and most striking species of the genus in Colorado. Masses of the pale yellow capillitium occur everywhere, usually on fallen logs of *Pinus.* So evanescent is the connection between the capillitium and the short-stalked calyculus that they are seldom found united. Boulder, Ouray, Tolland, on the South Platte and in the San Juan Mts., (Bethel); Colorado Springs, (Shantz); Glen Park, (Sturgis).

ARCYRIA VITELLINA, *Phill.* A most beautiful species characterized by its pyriform or clavate sporangia of a clear, shining, chrome-yellow or dull olivaceous color, resembling *Hemitrichia clavata.* The threads of the abundant capillitium are normally closely and minutely spinulose or warted; occasionally however, they show short transverse ridges in addition. Mr. Bethel has collected it in considerable abundance at Arrowhead, Tolland, and in the San Juan Mts.

Lister (Mon. p. 185) writes *"Arcyria versicolor, Phill."* and gives *A. vitellina* as a synonym. A strict interpretation of the law of priority compels the use of the latter name, since although Phillips described both forms on the same page of the same publication, the description of *A. vitellina* precedes the other.

PERICHAENA, *Fries.*

PERICHAENA DEPRESSA, *Lib.* Occurs commonly on the inner bark of Cottonwood and Willows in damp situations, but liable to be overlooked by reason of its much depressed sporangia and dull purplish brown or almost black color. After the falling away of the lid-like upper portion of the sporangia, however, the bright yellow mass of spores and capillitium is striking.

Collected in abundance at Colorado Springs, (Sturgis); Boulder, (Bethel & Sturgis); Denver, (Bethel).

PERICHAENA CORTICALIS, *(Batsch) Rost.* Commonly found in the same situations as the preceding species, but distinguished from it by its somewhat more globose sporangia, smaller in size and less densely crowded, its scanty capillitium, and its usually larger spores.

Common at Palmer Lake and Denver, (Bethel); Colorado Springs, (Sturgis).

PROTOTRICHIA, *Rostafinski.*

PROTOTRICHIA FLAGELLIFERA, *(B. & Br.) Rost.* This remarkable species is reported from various parts of the State but the specimens are all scanty. The globose sporangia are either sessile or stalked, and vary in color from cinnamon-brown to a much darker shade with metallic iridescence. The spore-mass is olivaceous. The branching, tapering, spirally banded capillitium-threads are quite unique.

Specimens are present from Tolland, Yankee Doodle Lake and Arrowhead, all collected by Mr. Bethel.

LYCOGALA, *Micheli.*

LYCOGALA EPIDENDRUM, *(Buxb.) Fr.* The commonest of all *Myxomycetes* everywhere. Collected in Colorado at Colorado Springs and Glen Park, (Sturgis); Palmer Lake, Arrowhead, and on the South Platte, (Bethel).

LYCOGALA FLAVO-FUSCUM, *(Ehr.) Rost.* The large spherical æthalia of this species are commonly found growing singly or in clusters of three or four on fallen logs and stumps. It is a much larger form than the preceding, sometimes attaining a diameter of 5 cm. The cortex before maturity is horny and covered with minute translucent warts; at maturity the surface is minutely areolated and varies in color from tawny to brownish black. All of our specimens are from Boulder and were collected by Mr. Bethel.

In conclusion the writer desires to express his indebtedness to the many persons who have made his work possible by furnishing specimens and notes. Especially is such recognition due to the writer's collaborator, Mr. Bethel, whose indefatigable zeal and unusual powers of observation have enabled him to secure the greater number of specimens recorded in this paper.

Thanks are also due to Prof. H. L. Shantz, now of the University of Nebraska; Mr. M. C. Hall, formerly a student at Colorado College; Mr. L. C. Bragg, of Fort Collins; Messrs. H. F. Watts and D. M. Andrews, of Boulder; Mr. W. Heustis, of Denver; and Mr. Geo. Osterhout, of New Windsor, all of whom have contributed specimens.

It is almost unnecessary to state that the writer is under deep obligation to Mr. Arthur Lister, F. R. S. and to Miss G. Lister, of London, as well as to Professor T. H. Macbride, of the State University of Iowa, whose invaluable advice and opinion has at all times been as freely given as asked.

No. 52. The Wm. J. Palmer Library of Astronomy and Meteorology.—*F. H. Loud.*

" 53. Review of *La Theorique des Cieux et sept Planetes . . . par* Oronce Fine, Paris, 1607.—*Mary A. Sahm.*

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